

PATENT SPECIFICATION

1,011,045



DRAWINGS ATTACHED

Inventor: BRIAN HOWARD ROGERS

Date of filing Complete Specification: Jan. 7, 1964.

Application Date: Jan. 24, 1963.

1,011045

No. 3021/63.

Complete Specification Published: Nov. 24, 1965.

© Crown Copyright 1965.

Index at acceptance:—F4 V(B1D, B3F, B4B, B4C, B4F, B4G); F4 H(G2B, G2L, G2M, G2N, G2T)

Int. Cl.:—F 24 f // F 25 b

COMPLETE SPECIFICATION

Improvements in or relating to Air Conditioning Systems for Aircraft

We, NORMALAIR LIMITED, of West Hend-
ford, Yeovil, in the County of Somerset, a
British Company, do hereby declare the invention
for which we pray that a patent may be
granted to us, and the method by which it is
to be performed, to be particularly described
in and by the following statement:—

This invention relates to an air conditioning
system for use particularly, although not ex-
clusively, in aircraft of the passenger carrying
type, and more particularly, although not ex-
clusively, to aircraft of the type that operate
at high altitudes and at speeds considerably
in excess of the speed of sound.
In a passenger aircraft containing, say 150
passengers, a considerable quantity of CO₂
and of body odours will be produced during
a flight. It is, therefore, necessary to remove
the CO₂ and the odours continuously, in order
to reduce their concentration to an acceptable
level. This is done normally by flushing the
fuselage continuously with a flow of fresh
air, taken from outside the aircraft, of at
least 1 lb./min./person, even when there is a
considerable degree of internal recirculation
of the air. The provision of this flow of fresh
air taken from the outside involves a consider-
able loss of power and the penalty of high
weight of equipment and aerodynamic drag,
and it is with this problem in mind that this
invention seeks to provide a system whereby
the fresh air flow into the cabin is reduced by
an amount greater than has hitherto been
achieved. By "air" we mean breathable
atmosphere from the ambient air, although it
may differ slightly in gaseous proportion from
the ambient air.

By reducing the intake of fresh air, the in-
vention seeks to reduce the problems associ-
ated with known means for supplying occu-
pants of an aircraft with pressurised air from
an ambient source. Among such problems are
aerodynamic drag, the weight of the necessary
equipment, and power losses.

[Price 4s. 6d.]

According to the invention there is pro-
vided an air conditioning system for an en-
closure of an aircraft, comprising a first con-
duit means for conducting ambient air to the
enclosure, heat exchange means for cooling
the air passing to the enclosure, the heat ex-
change means comprising part of the circuit
of a cooling system, a second conduit means
for recirculating air from the enclosure and
conjoining with the first conduit means up-
stream of the heat exchange means, a third
conduit means branching from and returning
to the second conduit means and providing
means for removal of odours and carbon di-
oxide from a portion of the air recirculating
through the second conduit, a first fan means
in the second conduit for urging recirculation
of the air, and a second fan means in the
third conduit means to urge therethrough the
portion of the air.

A preferred embodiment of the invention
will now be described by way of example
with reference to the accompanying drawing,
the single figure of which is a diagram of an
air conditioning system in accordance with the
invention.

Referring to the drawing, an air condition-
ing system for an enclosure of an aircraft in-
cludes a source of fresh air 1 conveniently
tied from one or more compressors of the
aircraft engines. This air passes through a
heat exchanger 2, where it is cooled by air or
fuel as generally indicated at 3. The cooled
air is then split into three streams 4, 5 and 6,
one stream 4 of which is connected to a re-
circulatory system for the aircraft enclosure
at 14, while the other two streams 5 and 6
are led off to drive turbines 7 and 8 respec-
tively.

Turbine 7 drives a gas recirculating fan 9
and the turbine 8 drives a pair of compressors
10 and 11 in a refrigeration or cooling sys-
tem. A further turbine 12 is also driven by
bleed air from one or more compressors of

Price 3s 6d

Price 3s 6d

the aircraft engines by means of a suitable connection (not shown) and this turbine 12 drives a fan 13 for a purpose to be described.

5 The bleed airstream 4, having been joined by the recirculating system at 14 mixes with the recirculating air and passes through a heat exchanger 15 cooled by the abovementioned cooling system. The airstream 16, from the heat exchanger 15, then enters the aircraft enclosure.

10 Air is withdrawn from the enclosure in a stream 17, and is split into two streams 18 and 19. The stream 18 passes directly (and through such valve control as may be appropriate) to the recirculating fan 9 and back to the enclosure by way of the heat exchanger 15. The other stream 19 is sucked through a carbon dioxide extractor 24 and a deodoriser 20 by the circulating fan 13 before returning 15 to the enclosure by way of the fan 9 and heat exchanger 15. The carbon dioxide extractor may be of any desired type and could, for example, use lithium hydroxide to absorb the carbon dioxide. This extractor will reduce the amount of flushing air necessary. The deodoriser may be of any desired type, such as a chemical extraction unit using activated charcoal.

20 It will be noted that only a part of the recirculated air passes through the deodoriser 20, and this assists in reducing power losses, as it has been found that the passage of all the air through the deodoriser is not necessary to keep the odour level in the recirculated gas acceptable.

25 The cooling system for the recirculated air is of known form, and comprises the aforementioned heat exchanger 15 with its associated expansion valve 15A and compressors 40 10 and 11, and a condenser 21 and subcooler 22 with its associated expansion valve 22A. The system shown works on a closed circuit refrigeration system of the compression, condensation and evaporation type. Condensing of the refrigerant is carried out in the condenser 21 by means of a heat exchanging arrangement with air or fuel feed as indicated at 23.

30 Various modifications may be made to the above described air conditioning system without departing from the scope of the invention; as defined by the appended claims. For example, the turbines 7, 8 and 12 may be replaced by electric motors, either collectively

or individually. Alternatively, the turbines could be driven by ram air derived outside the aircraft.

35 The cooling system shown may be replaced by other cooling systems such as any suitable air cycle system. Such a system could incorporate a "boot strap" arrangement whereby the air supply from the engine compressor passes through a primary cooler, and is compressed by the compressor in a cold air turbine unit, and then passes to the turbine. The air entering the turbine converts heat energy into work by making the turbine drive the compressor which causes a reduction in air temperature through the turbine. Heat gains caused by the action of the compressor are cancelled out by passing through a heat exchanger before entering the turbine.

40 If desired the carbon dioxide extractor 24 may be omitted. Dehumidifying means may also be provided at an appropriate point in the recirculation system, e.g. in series with or incorporated with the deodoriser 20, or with a carbon dioxide extractor unit if such be present.

WHAT WE CLAIM IS:—

45 1. An air conditioning system for an enclosure of an aircraft comprising a first conduit means for conducting ambient air to the enclosure, heat exchange means for cooling the air passing to the enclosure, the heat exchange means comprising part of the circuit of a cooling system, a second conduit means for recirculating air from the enclosure and conjoining with the first conduit means upstream of the heat exchange means, a third conduit means branching from and returning to the second conduit means and providing means for removal of odours and carbon dioxide from a portion of the air recirculating through the second conduit, a first fan means in the second conduit for urging recirculation of the air, and a second fan means in the third conduit means to urge therethrough the portion of the air.

50 2. An air conditioning system as claimed in Claim 1, wherein the ambient air supplied is bleed air from the aircraft engine air supply.

55 3. An air conditioning system for an enclosure of an aircraft substantially as described with reference to the accompanying drawing.

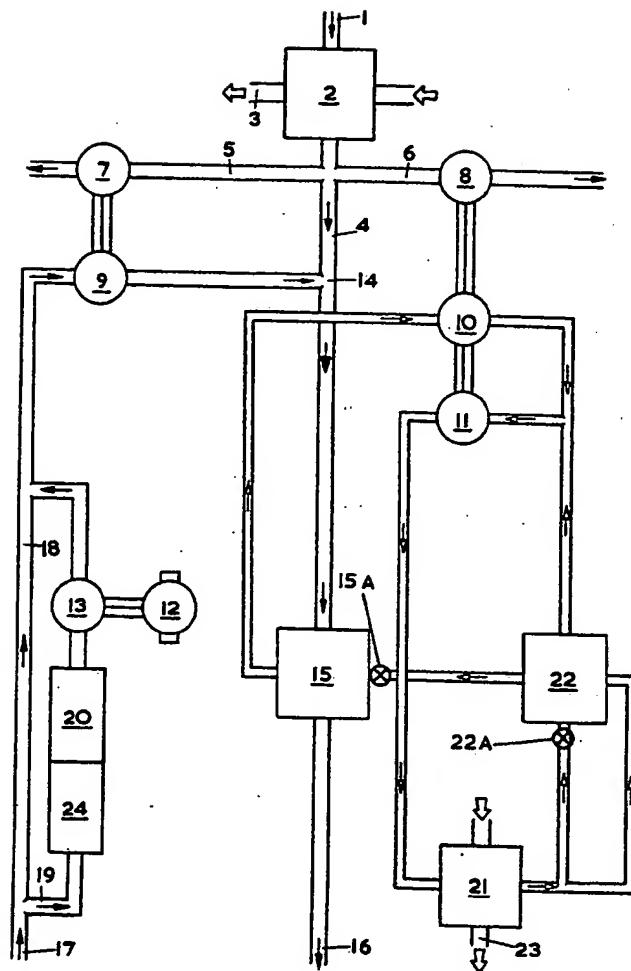
For the Applicants,
L. H. HAYWARD.

Leamington Spa: Printed for Her Majesty's Stationery Office, by the Courier Press (Leamington) Ltd.—1965. Published by The Patent Office, 25 Southampton Buildings, London, W.C.2, from which copies may be obtained.

1011045 COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of
the Original on a reduced scale*



THIS PAGE BLANK (USPTO)